with which pigeons feed their young and find that it is not a glandular secretion (as is the material with which the Callocalia constructs its edible nests), but is a formation of modified epithelial cells. This material is produced in the œsophagus of both the male and the female parents until about the twentieth day after the eggs have hatched.

EMBRYOLOGY.[1]

WHY DO CERTAIN FISH OVA FLOAT?—In a recent paper, by a Mr. Prince (Ann. and Mag. Nat. History, 1886), his readers are informed that the buoyancy of certain fish ova is not due to the presence of drops of oil in the yolk as supposed by Ryder, or words to that effect. Had my conclusions not been so summarily disposed of by one whose information is clearly not very accurate or extensive, the writer would not trouble himself to reconsider the subject of the buoyancy of fish ova. In my Embryography of Osseous Fishes (p. 118), I have stated that "the buoyancy of the cod's egg is undoubtedly due to the diminished specific gravity of the protoplasmic matter of the vitellus, and not to the presence of any oils. In this respect it represents an unique type of the buoyant ovum." This statement, published in 1884, but written in 1882, is essentially the same as that of Mr. Prince, published in 1886. Comment is unnecessary.

There are several types of buoyant ova. These are: (1) Those in which the specific gravity of the yolk is diminished, as in the egg of the cod; (2) those in which large oil-drops in an eccentric position aid in causing the eggs to float; (3) those in which a very large oil-drop caused the ovum to float even in fresh water.

These three categories are also, in all probability, connected by intermediate kinds; that is, amongst forms of the second series there are some which are buoyant in water with as low a specific gravity as 1.014, while others are not buoyant in water of less specific gravity than 1.025, while those in which the proportion of oil to plasma is very great, or about as 1 to 7, are buoyant in water with a specific gravity of very nearly 1.000, or in that which is fresh.

As a rule, the buoyant ovum has the oil gathered into a single drop embedded in the vitellus nearly opposite the germinal disk; there seem to be few exceptions to this rule. There are also but very few species known which have buoyant ova without an oil drop, and these are buoyant only in water of rather high specific gravity. Furthermore, as a rule, fish ova which are buoyant are not adhesive, but float about near the surface singly; the most noteworthy exception to this rule is presented by the great pelagic egg-ribbons of Lophius.

[1] Edited by JOHN A. RYDER, Biological Department, Univ. of Penna., Philadelphia, Pa.

The great majority of species of both fresh and salt water fishes, which have heavy, subsident ova containing oil, have their eggs provided with thick, heavy membranes, which are adherent to each other or to foreign bodies, or to both. Furthermore, their egg-membranes are usually adhesive, with the oil-drops scattered beneath the surface of the vitellus, or aggregated in a flat, discoidal group beneath or alongside of the germinal disk, and not very transparent. The whole egg is also usually more or less colored or granular. The egg-membranes of those species which have buoyant ova are, on the other hand, characteristically thin and delicate, so that it is difficult, if not impossible, to make out the presence of pore canals, while the whole egg is, as a rule, remarkably transparent.

These characteristics seem to show that the buoyant ovum is a very well-defined and specialized type, which has been developed in the course of the struggle for existence to serve a very useful purpose in insuring the protection and survival of the embryo during the hatching period.

There are fresh-water forms, also, which have buoyant ova, as in the case of *Macropodus venustus*, in which the proportional volume of the oil-drop is greater than in any other known type. The oil in this case when liberated at once floats at the surface, as does the egg when entire, while the plasma of the germ and vitellus at once sinks. This fact, it seems to me, finally and conclusively proves that the pelagic or buoyant habit of many fish ova is due to the presence of oil aggregated, as a rule, at the vegetative pole of the vitellus in the form of a single drop. The other conditions are (1) that the egg be free and not adhesive, with a thin membrane, and (2) that it be immersed in water having a greater density than 1.014. The one notable exception to the last part of this general statement, viz., Macropodus,[1] it seems to me, serves to show that the presence of oil is very important, and may exceptionally be the sole cause of the buoyancy of the egg.—*John A. Ryder.*

THE ORIGIN OF THE PIGMENT-CELLS WHICH INVEST THE OIL-DROP IN PELAGIC FISH EMBRYOS.—During the past summer, in observing the development of the common mackerel, *Scomber scomber*, I noticed that pigment cells began to appear on the innermost side of the oil-drop before the tail of the embryo had become prominent. Noting the condition of the oil-drop, and its relation to the surrounding structure, it was noticed that a thick layer of protoplasm invested it. This investing layer of protoplasm, it was also observed, was absolutely continuous, with the layer of periblast enveloping the yolk. Consequently, the only source from whence the nuclei of the pigment cell surrounding

[1] For an opportunity to study the development of this form, I am indebted to my friend Wm. P. Seal.

the oil-drop could have been derived was the periblast. That layer being hypoblastic, so far as its morphological relations are concerned, it follows that the pigment cells which are developed around the oil-drop in Scomber, Scomberomorus, Chætodipterus, etc., arise from the hypoblast.—*John A. Ryder.*

LIFE HISTORY OF THALASSEMA.[1]—This very useful memoir deals with a type, the phyletic history of which is very obscure. The author concludes that Thalassema is an Annelid in which simultaneously with the lengthening of the alimentary canal, there has been a suppression of metameric segmentation. The ova are developed from free plastids, which become detached from the peritoneum, and float about in the perivisceral fluid, in which they grow to maturity. The eggs when discharged are buoyant; undergo a total and equal segmentation, accompanied by the expulsion of two polar globules; the first one of these finally undergoing subdivision into two. An invaginate gastrula is formed, which elongates as the stomach is formed; the latter is then subdivided by three constrictions, bends upon itself, and finally unites with the body-wall, and the anus breaks through at a point corresponding to one end of the blastopore, which has, in the meantime, become elongated. The embryo, at first covered by cilia, finally developes preoral, postoral and perianal ciliary girdles, and thus becomes a trochosphere. The ectoderm opposite the gastrula mouth becomes thickened to form the beginning of the nervous system, the second part of which is developed later as a ventral ectodermal thickening, occupying the position of the closed lips of the lengthened blastopore. The muscular system arises from two mesodermal bands near the anus, which grow forward and become segmented. In the course of further growth the segmentation disappears, the preoral lobe becomes filled with muscular tissue, the setæ appear as mesodermal organs, the anal pouches arise as ectodermal invaginations, and finally admit, through their internal openings, a large quantity of water into the body cavity, which causes the animal to increase much in size.

The larva finally finds its permanent home in some cavity in a sand-dollar shell. Here, by means of its preoral lobe, which has now become long, flexible and muscular, and by the aid of secretions from dermal glands, it arranges for itself rough chambers in the sand with which the shell is filled. In this chamber it remains a prisoner. Here it grows to maturity, completely secure from external attack. Its only means of communication with the exterior is through the small oral opening of the sand-dollar shell, and through this it must obtain all its food and cast its sexual products when mature.

The speculations of the author as to the origin of irregular seg-

[1] H. W. Conn, Studies from the Biolog. Lab. Johns Hopkins University, III, No. 7, pp. 351–401, pls. XX–XXIII, 1886.

mentation (on page 370 and *infra*) do not seem to the reviewer to be borne out by the facts. On page 373 he says: "The object of food-yolk, as is well known, is to enable the young to abbreviate its development by having its food supplied, and being consequently able to skip some of its ancestral stages." Instead of this being the fact, exactly the reverse is true, as has been shown by Balfour, Cunningham and myself.—*John A. Ryder.*

PHYSIOLOGY.

SOME NOTES ON RECALCIFICATION OF HUMAN TEETH.[1]—The extent to which human development depends upon the proper utilization of food is such that any fact bearing upon the success of this process becomes of paramount importance.

Living in a section of country where diet and drink are unusually deficient in calcific elements, my attention was many years ago called to the analogous condition of the teeth of children in that region, which, as a rule, are characterized by a corresponding deficiency in calcific elements.

Rapid and remarkable changes also occur in the condition of the teeth of adults—almost in direct ratio to their changes of environment in this respect. The "baker's bread" and other food products in most general use by the inhabitants of the region near the Gulf of Mexico, and more especially by the inhabitants of cities, are largely divested of calcific elements, while the water used for potable purposes is almost exclusively rain water, which, though a good solvent, contains no mineral elements.

The wonderful power of adaptation possessed by our race is such that people, living in this region for a number of generations, acquire the power of appropriating, from the meager supply thus furnished, the necessary elements to produce fairly good teeth; but the very large number of residents, not natives of this section, whose early life and the life of their ancestors, has been spent in regions where calcific elements were more abundant, and whose constitutional habit was accustomed to that abundance, are not able to assimilate, out of this meager supply, the requisite proportion of limesalts.

The function of utrition being dual in its character—removing effete and worn-out material on the one hand, while supplying the elements to maintain the integrity of the tissues on the other—the calcific elements, which form the inorganic basis of tooth-substance, and which rendered the teeth hard and firm, are carried away, while the supply to rebuild, being deficient in quantity, the corresponding amount is not restored, the teeth in consequence soon become decalcified and softened, falling an easy prey to unfavorable conditions.

[1] Read before Sections F and H in joint session, Buffalo Meeting A. A. A. S., August, 1886.